THESIS

on

TYPHUS FEVER

WITH SPECIAL REFERENCE TO ITS OCCURRENCE IN SOUTH AFRICAN NATIVES,

by

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INTRODUCTION.

Typhus fever has probably been prevalent amongst the human race from time immemorial and has been the almost invariable accompaniment or sequence of these periods of famine and misery so often concomitant with the great wars of the past. In spite of this long history our knowledge of the disease is far from complete firstly on account of the fact that during the period of progress in medical research which preceded the Great War, comparatively few cases of typhus fever occurred in Europe. During the Great War and the period subsequent thereto, conditions being favourable, there was a marked increase in the incidence of the disease, largely in the epidemic form , and some progress has been made in the elucidation of some of the problems connected with it. Much however remains to be done. During the long history of typhus fever many names have been given to it such as - Spotted fever, Jail fever, Prison fever, Ship fever, Hospital fever, Camp fever, Famine fever, Morbus Hungaruus, Synochus Putrida(given by Willis who described the disease in 1681), Brill's disease to mention a few, the variety of names being some index as to the conditions under which it was found. Cullen adopted the name typhus for the disease and this is the term now generally used throughout the English-speaking world.

Typhus fever is practically world wide in its distribution, few countries remaining free from infection and few have not suffered at one time or another from a devastating epidemic of this disease.

It is therefore interesting to deal with the geographical distribution of typhus fever in view of its recent history.

Typhus fever is endemic in Eastern Europe and the most of Asia with periodical outbreaks in epidemic form especially during the years 1904-1914 inclusive. In Galicia alone 24,107 cases occurred with 2283 deaths. Russia suffered severely during the period 1904-1911 inclusive approximately 665,865 cases with 54533 deaths having occurred. The Balkan States are liable to severe outbreaks as witness the serious epidemic in Serbia in the year 1915 and thereafter. Turkey, Bulgaria, Salonica are also endemic centres for this disease. France, Spain, Italy, Norway and Sweden are fairly free from infection and in England and Scotland typhus is rarely seen. Ireland, however, always has a few cases occurring and as recently as 1914 thirty-seven deaths from typhus were recorded.

Japan suffers from yearly outbreaks in the province of Hiogo. Ceylon, Australasia and Oceania are so far free from typhus infection. Canada and the United States of America have cases from time to time but these are usually due to the disease being imported through immigrants. In Mexico many cases of typhus fever occur in a rather virulent form, it being locally called "tabarillo" and many deaths are credited annually to this disease. In South America only Peru and Northern Chili seem to be infected while the West Indies are free. Typhus fever is endemic in the States on the Northern

and Eastern borders (Tunis, Algiers, Tripoli, Egypt, Abbysinia, Nubia etc.) and in Egypt alone during the first six months of the year 1915, 14505 cases occurred with 3398 deaths amongst the native population. In South Africa the disease is very prevalent amongst the native population, and is in fact the most prevalent of all notifiable infectious diseases, over 8000 being notified annually and these are only a proportion of the cases occurring. Over 300 cases occur annually amongst the white population these being mostly due to accidental infection through natives.

HISTORICAL.

Typhus fever was first described by Fascatorius of Verona as far back as the early part of the 16th century in his work entitled "De contagione et contagiosis morbis" and he differentiated the disease from plague by describing the petechial rash and therefore the name"Petechial fever" was frequently applied to the disease at that time. Since then the pages of history have been marred by records of the ravages of this disease as it has proved itself to be one of the greatest if not the greatest epidemic disease of the world and has almost consistently visited areas devastated by war and famine throughout the centuries. In the retreat from Moscow 1812-1813 the French losses from typhus were enormous and in the Crimean War both French and Russians lost heavily from the same cause. Ireland was visited by a serious epidemic between years 1817-

1819 and again in 1846. About that time typhus also prevailed in the large cities of England and the Continent of Europe and in the year 1875 1499 deaths are credited to this disease in England and Wales. In the Russo-Turkish war of 1878 over 48000 cases with 16000 deaths occurred among the Russian troops. During the Great War the British and French troops did not suffer from any epidemic of typhus fever, but the Germans, Austrians, and Russians, were all heavily involved. The civilian populations in these countries were also affected and in the prisoners of war camps in Germany owing to the faulty hygiene and almost famine conditions existing there, there was a high incidence of the disease with a high mortality. The Balkan States suffered considerably during the early period of the war especially Serbia during the period January to June 1915 when infection was brought there by the Austrian prisoners, and conditions being suitable, a very serious epidemic broke out. Hunter estimated that over 500,000 cases of typhus and relapsing fever occurred with 120000 deaths mostly from typhus fever.[1] A severe epidemic occurred in Turkish Army in Mesopotamia in 1915, 1916, 1917 the infection spreading through prisoners to the British and Indian Army there engaged in 1917, 1918.[2]

In South Africa in the year 1867 an epidemic occurred in several districts of the Cape but worst of all in Cape Town, which was described as a low type of fever. It was estimated that one in five of the population was attacked and it was noted to be specially severe amongst the coloured people and the lower type of Europeans. Many medical men were attacked and the mortality of the disease was high, it being stated that over 1000 persons died in Cape Town alone. A medical committee was formed to investigate the matter and they attributed the disease to dirt, want, and overcrowding. The records of the symptoms are scanty but such as they are they suggest typhus.

Although this is the first record of the disease in South Africa ~~and~~ or of a disease resembling typhus fever, it is probable as Sheldon suggests[3] that it has existed there from the earliest times as the mode of living and hygienic conditions of the natives have been very suitable for the continuance of an infection of this variety. Various similar outbreaks of disease occurred after this (1867) in various parts of the Colony which are referred to variously as low fever, typho-malarial fever and Cape Typhus. It was reported by a medical man as present in the Tsomo district in 1887 but the first investigation by Government Medical officers was made in the King William's Town district in 1900. The cases then examined were found to present similar symptoms to those of typhus but no rash was found. Numerous small outbreaks of this disease which the natives referred to as

"ifiva-nyama" or black fever (owing to the fact that the tongue becomes covered with a dark brown fur), or "mbatelala" (Knock down disease) occurred but mostly in the more inaccesible locations in the Transkeian and Ciskein districts. The difficulties of diagnosis there are very great as one only saw cases which had been ill for several days and at that period the symptoms resembled those of a bad case of typhoid fever, a disease very prevalent at that period. In 1916 a serious outbreak occurred amongst the natives in Queenstown location where a certain number of Europeans were infected. These cases were at first thought to be typhoid as few natives showed rashes, but with the presence of rashes on most of the European cases the diagnosis was established. Several nurses were attacked also Dr.Rees one of the Government Medical Officers. The latter developed a typical attack with characteristic skin symptoms, unfortunately the attack proved fatal.

Considerably over eight thousand cases are notified annually and as under the conditions existing many cases escape notification it is highly probable that as Sheldon suggests three times as many cases actually occur.[3] The undernoted table shows the number of cases notified during the first six years after typhus fever was definitely recognised as being present in South Africa and it will be noticed after the first gradual increase in the number of notifications the incidence of the disease seems to have become more or less stabilised.

	Whites.		Coloured.		Total.	
Year.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1917	31	5	3935	832	3966	837
1918	9	3	2699	492	2708	495
1919	25	4	4803	1118	4828	1122
1920	81	12	11195	1779	11276	1791
1921	132	17	9,025	1123	9157	1140
1922	60	11	8,471	1020	8531	1031

During the long history of this disease nothing was done to establish its bacterial origin until in 1909 Charles Nicolle found he could reproduce the disease in monkeys by the injection of blood serum from an infected patient. After this numerous organisms have been discovered and credited with being the causal agent in typhus but no absolutely definite proof is yet forthcoming on behalf of any one of them. Bacilli were discovered by Horuiche in 1909, Ricketts and Wilder 1910, Plots 1914 (Bacillus typhi-exanthematici), Rabinowitsch, Arnheim, Rudisjincinsky, Petruskey 1915, Zeis 1917. Cocci by Wilson 1910, Proescher 1915, Penfold 1916, Danielholm 1917. Pleomorphic organisms by Prejetchensky, Fuerth, Mueller.
Hart, Ingram, Toplin and Gaston. Spirochaeti by Fulaki (1915). Mobile diplo baccilus by Goldstein and Non mobile diplo baccilus by Mulman. Wolbach and Tod believed Mexican typhus to be due to a new parasite Dermacentroxemus Typhi (1920). Roche Lima in 1916 discovered the so-called Rickettsia bodies in infective lice and demonstrated the part they played in the transmission of the disease. Weil and Felix, and Felix

and Friedbeyer about same time (1916) discovered the Bacillus proteus in faeces, and urine of patient with typhus and suggested it was a causal agent of the disease.

While evidence to this effect has been inconclusive the serological test for the disease made possible by the discovery of this organism has proved of the utmost value. A Weil Felix reaction being obtained in 90-100% of all cases in a dilution up to 1-30000, fifty per cent of cases giving this reaction by 5th day and all by the 10th. It is therefore obvious that the value of this reaction is very great and the discovery of this organism marks a great advance in facilitating our diagnosis of this disease.

MORBID ANATOMY.

While pathological changes after death from typhus fever are mainly those which might result from any internal febrile condition there are certain additional points worthy of note as follows. The muscles are usually of a deep colour and Jaffe records their remarkable dryness and also the greasy appearance of the peritoneal surfaces. There may be granular degeneration of the heart muscles and the blood is usually dark and fluid. There are frequently very small haemorrhages in the skin, kidneys, pleurae, pericardium, and mucuous membrane of stomach and intestine and in the bladder. The

liver is sometimes enlarged and soft and on section may show a dull clay-like lustre. The spleen is usually moderately enlarged in earlier stages of the disease but smaller later.

Fränkel and Jaffé have almost constantly found characteristic microscopic nodules of cellular charge in wall and adventitia of small arterioles. These nodules show necrosis and increase of endothelial layer which is infiltrated with large mono nuclear sglia cells, plasma cells and later to a less degree by polymorphonuclear leucocytes , the vessels affected being often thrombosed. In cases dying after the 10th day of the disease these nodules are definitely visible and slight changes have been observed as early as the sixth day. The vessels in any of the internal organs may show these changes but they are more constant and more easily found in those of the mid brain in the region of the "iter". Jaffé claims they are so characteristic as to enable a diagnosis to be established as early as the 7th day and as late as the 70th. Similar changes are found in guinea pigs infected with typhus virus. Kucziniki (1919) noted the occurrence of forms of the Rickettsia prowazeki inside the Endothelial polymorphonuclear cells in the nodules described by Forkel in the vessels of the brain in man and in guinea pigs infected with typhus. Wolbach and Todd found these organisms also in the skin spots and Kucziniki and Jaffe found rickettsia in the large endothelial cells from the liver.

SYMPTOMATOLOGY.

INCUBATION. The incubation period of typhus fever is usually believed to be about twelve days but it may be less. Murchison considered it to be sometimes as little as one to three days and Curschman reports one case in which four days was proved. Claude Ker notes two cases with definite period of 12-13 days but the period of incubation may be expected to vary in proportion to the strength of the virus in the louse which infects the patient.

INVASION. The onset is usually sudden but sometimes it is preceded by headaches, giddiness and general malaise or a feeling of general discomfort.[4] On the other hand Wolbach states in Serbian epidemic the onset is sharply defined.[5] Sir P. Hehir in his report on a Greek epidemic found that in the majority of cases the onset was slow. It is frequently ushered in by a sudden rigor or repeated attacks of shivering followed or accompanied by severe headache (usually frontal) and severe pains in back and legs. Vomiting is often a very distressing symptom should it occur, and nausea is often present if vomiting is not. Epistaxis is a frequent symptom. The temperature rises rapidly to 103°F or more, the expression becomes dull and heavy, the face being flushed, conjunctiva injected and eyelids somewhat swollen. The pulse rises to over 100 beats per minute and is usually full and compressible, respirations are

accelerated and there is usually a slight cough from the concurrent bronchitis which so frequently accompanies the disease. Constipation is the rule, diarrhoea being rare and the urine is scanty and high coloured. The tongue is usually large, pale and coated at first and delirium and deafness are often early symptoms, their severity being in proportion as a rule to the severity of the attack. There is usually a catarrhal condition of the naso pharynx and some redness of the pharynx and tonsils. Murchison records tenderness over the hepatic region[6] but the writer cannot confirm this as there is usually no pain or tenderness over the abdomen unless from straining from vomiting. The spleen is enlarged and soft and can usually be felt early in the disease. Prostration is an early and marked symptom and patient is very glad to lie up.

STAGE OF ERUPTION. The eruption of typhus fever usually appears from the 3rd to the 5th day of illness and shows up first on the anterior fold of the axillae and the sides of the abdomen then on the chest, back, shoulders, thighs and arms. The rash is very similar in appearance to the "rose" spots of typhoid fever but is usually much more distinctive and widespread and it appears all at once and not in successive crops. For the first day or two the spots which are papules fade on pressure but afterwards become dull red and non-fading and later about the tenth day become brownish red and then

gradually disappear. About the fifth day the papular rash just described becomes intermingled with numerous blotchy red macules about the size of a threepenny piece. These like the papules at first disappear on pressure but after a day or two do not andeventually turn brownish red about the tenth day and eventually disappear. The intensity of the rash and its distribution varies in different cases, mild cases showing very little rash, while should it become purpuric in appearance the prognosis of the case is very bad as such a marked rash is often accompanied by severe symptoms such as haematuria, haematemesis, melaema and a fatal termination is to be expected. The rash is haemorrhagic in character and therefore does not disappear after death. Some cases show no rash Helier found 1% of such cases in a Greek epidemic [4]

SECOND WEEK. During the second week the symptoms become more aggravated and the prostration is more marked. Delirium often now develops or if present becomes much more severe and continuous. Deafness is now usually well marked and patient has a dull expressionless appearance having a flushed face with injected conjunctivae and contracted pupils. The pulse is more rapid and feebler and may be irregular and retention of urine is common. The tongue is dry, brown and cracked and sordes gather on the teeth, the breath is foetid , and a peculiar "mousey" odour has been described as being characteristic of the disease. The respirations are accelerated, the

bronchitis, if present, more marked, and the heart becomes more enfeebled and death may now take place from exhaustion. In favourable cases the patient will often about the 12th to 14th day drop into a quiet sleep and on waking will be found much better with a falling temperature and improving pulse, and generally feel like a different man. Although extreme prostration is usually found at the end of the illness convalescence is as a rule rapid and uninterrupted. In the adult the duration of the disease is as a rule 14 days but in children and in mild cases/it may run a somewhat shorter course. Should it last longer than two weeks/it is usually due to the presence of some complication and it is of serious significance. Having discussed the main symptoms and given a general description of the disease it would now be well to deal in more detail with several of the more important symptoms and later with the commoner complications and sequences.

FEVER. The fever rises rapidly in the first few days of the illness and showing little morning remission attains its maximum about the 4th or 5th day remaining thereafter fairly constant until the 12th day. The temperature falls usually from the 12th to 14th day by a rapid lysis (taking 3 or 4 days to fall to normal) or more rarely by crisis. In many cases there is a pseudo crisis early in the second week but in that case the drop in temperature is not co-incident with any great improvement in the pulse rate or the patient's general condition

In mild cases and in children the fever does not always continue for so long a period.

NERVOUS SYMPTOMS. Patient is usually dazed and confused and frequently there is continued delirium, tremors, twitching of muscles, tremors of tongue, and stupor commonly occur during second week and in severe cases earlier. Deafness may be marked and an early symptom. Sometimes patients become maniacal and attempts at suicide have been recorded. Knee jerks are lost early in severe cases and incontinence may come on early and continue for some time after temperature is normal. The cerebrum is more affected by typhus fever than by any other acute disease and it may take six months or more to recover normal power of mental concentration.[7] In the acute stage there may be retraction of head, delirium and meningeal symptoms.

GASTRO-INTESTINAL SYMPTOMS. Loss of appetite, nausea and vomiting, constipation and rarely diarrhoea are the principle symptoms affecting the gastro-intestinal tract. In famine cases sometimes a loose bloody diarrhoea occurs which is negative to examination for organisms of dysentry and in such cases prognosis is bad.

RESPIRATORY SYSTEM SYMPTOMS. A catarrhal condition of naso-pharynx may occur and this may be followed by laryngitis and tracheitis of a severe type. Bronchitis in some degree is almost constant and it tends in severer cases to broncho-

pneumonia and sometimes pleurisy and empyaema.

CARDIA VASCULAR SYMPTOMS. The heart is frequently dilated and heart failure may ensue even early in the disease. The first sound becomes often feeble and a systolic murmur at the apex is fairly common.

URINARY SYMPTOMS. Albumen due to the febrile condition is usually present and the urine shows usual characteristics of fever. Chorides are diminished or disappear.

COMPLICATIONS AND SEQUELAE. Relapsing fever may occur in association with typhus fever especially under famine conditions and similarly under those conditions severe gastro-enteritis as previously described is an occasional concomitant. Malaria may also occur in association with typhus.

CARDIO- VASCULAR COMPLICATIONS. As might be expected in a disease showing such intense prostration, myocarditis is a common complication. The pulse becomes rapid, feeble and often irregular. The heart shows signs of dilatation, the first sound becomes feeble, and rhythm may simulate foetal type. In severe cases endocarditis may occur and pericarditis is not uncommon. Thrombosis of veins especially femoral may occur in acute stages and arterial thrombosis appears from time to time and if patient survives acute stage of disease dry gangrene supervenes, the feet being the usual part affected.

RESPIRATORY COMPLICATIONS. The larynx may become intensely inflamed and in rare cases ulceration of cords and cartilages

may follow with sometimes oedema of the glottis. Bronchitis is practically constant and is frequently followed by broncho-pneumonia which in severe cases may lead to abscess and gangrene of lung. Pleurisy and empyaema sometimes occur.

INTEGUMENTARY COMPLICATIONS. Unless great care is observed bed sores are liable to develop over sacrum, trochanters, and heels especially in these cases where coma has developed or is prolonged.

RENAL COMPLICATIONS. Albumen is present in urine in the vast majority of cases but is due to the febrile condition, true nephritis rarely occurs.

MINOR COMPLICATIONS. Inflammation of the parotid with subsequent suppuration occasionally occurs and similar conditions in the middle ear and lymphatic glands are observed from time to time.

NERVOUS COMPLICATIONS. Neuritis, meningitis and hemiplegia have been described but are rare. Marked impairment of cerebral functions almost invariably follows a severe attack and six months may elapse before recovery. Other mental sequelae such as neurasthenia and melancholia may follow this disease.

TUBERCULOSIS AS A COMPLICATION. Miliary tuberculosis has been described as occurring in the acute stage of this disease and patients who have quiescent tuberculosis may have an acute exacerbation of their condition as a consequence of an attack.

IN SOUTH AFRICAN NATIVE. While the foregoing will serve as a description of the disease as it occurs in most European countries,[8] although different epidemics show variations, it will be necessary here to consider the type usually found in the African native. Amongst Europeans in S.Africa the disease conforms to the European type but even in severe cases the rash is not developed to a marked extent, which as we will see is a feature of the condition in natives. In the majority, in fact almost all cases noted by writer, in the native, the onset is sudden. It must be admitted that here, where one deals with individuals of limited intelligence, a good history is difficult to get, but the frequency with which you hear that patient "took ill with shivering while at work" leads one to accept the history as being correct in most cases. The patient looks dull and heavy and corysal symptoms are often marked while in about 10% of the cases there is a false appearance of brightness and vivacity. Nausea and vomiting are not at all common the usual complaints being a "feeling of cold", weakness, and marked prostration. The temperature rises to 103°F and over and the pulse to about 100 or over. In many cases the pulse is comparatively slow in comparison to the temperature often running at 90-100 p.minute with temperature of 103° to 105° and it continues so until from 11th to 12th day when it suddenly increases in rate to from 110 to 130 or even 140 and remains so until improvement takes place. It is extremely difficult to

see the rash in many of these native patients and to make certain it is essential to attend to the following points. 1.See that there is good daylight available. 2.Wash (off) skin with ether soap to remove accumulated sweat and grease. If these precautions are taken a rash will be clearly seen in about 50% of cases examined, it will be faintly seen in about 30% and will not be seen in about 20% of cases. It is this difficulty about the rash that causes so much trouble in the diagnosis of this fever amongst coloured races and its absence in a sporadic case can well cause considerable confusion and prevent the recognition of earlycases often with disastrous results.

The factors which in the writer's opinion cause the faintness or absence of rash in native cases are 1.Mild cases which even in European epidemics show no rash. 2.Deeply pigmented skins where no differentiation is possible. 3. Tougher, thicker, firmer skins of natives prevent small haemorrhages occurring in them.

The fever lasts approximately as long as in Europeans but many mild cases do not have fever for longer than 10 days and in children seven days is often the duration of the disease. The fever usually subsides by rapid lysis few cases of crisis have been seen and unless the illness is severe rapid recovery takes place.

Delirium is common in the more severe cases but deafness is

a marked phenomena even early in the disease and is of marked importance for the clinical diagnosis of the condition. Cardio-vascular trouble is rare here as in any illness in a native, the heart rarely causing any anxiety except in severe cases. Corysal symptoms are usually well marked and bronchitis is present in a large number of cases but this varies to some extent with the severity of the weather at the time of illness.

Complications are rare in native cases the most common cause of death being exhaustion usually due to want of proper nursing and feeding. The commonest of complications is broncho-pneumonia and when this appears and becomes moderately well-developed it almost invariably heralds a fatal termination. Laryngitis has been seen on two occasions and nephritis on one. Meningeal symptoms with retraction of head and with apparently definite indication of meningeal complication have been seen at several times and have invariably proved fatal. Taking all points into consideration typhus fever in the native is a much less serious disease than in Europe and has in the writer's opinion a very much lower death rate.

DIAGNOSIS. In a typical case with rash, mental symptoms, absence of knee jerks, such as occurs during an epidemic there is usually no difficulty in the diagnosis. In the first

few days of the disease before these typical symptoms are properly developed it may simulate any of the acute diseases such as relapsing fever, smallpox, influenza etc. In mild cases and cases without a rash or with a faint rash there is considerable difficulty in arriving at a diagnosis especially in the absence of an epidemic and here reliance should be placed on the absence of knee jerks and the Weil Felix test. On the other hand cases with marked head symptoms resemble cerebro-spinal fever and here again the laboratory tests plus examination of cerebro spinal fluid is usually sufficient to establish a diagnosis.

WEIL FELIX REACTION. The Weil Felix test is of such importance and gives such valuable assistance in the diagnosis of typhus fever that some details concerning it will be of interest. It may be done by using a living culture or by an emulsion of dead organisms but the former is more satisfactory and is ised wherever possible. In the first method a culture of B proteus X19 on a neutral ager slope is emulsified in 1.5 c.c. of Salt Solution (,85%) Small agglutination tubes each containing one c.c.of a dilution of patients serum ($\frac{1}{25}$ $\frac{1}{50}$ $\frac{1}{100}$ $\frac{1}{200}$) are prepared and to each is added a drop of the thick emulsion of living bacilli. After mixing the tubes are put into an incubator at 37°C centigrade for 8 hours and the results

then read. If result is positive higher dilutions can now be tried. In the second method emulsions of dead bacilli are employed these being killed by heating to 50°C for ½ an hour or to which 1% formalin or 0.5% phenol has been added. This dead emulsion may often remain stable for some months. It is claimed for this test that the serum of all patients suffering from typhus fever will agglutinate the emulsion, the first method with living emulsion being the most reliable. In 75% of the cases agglutination is obtainable about the 4th day and the highest titre is reached just before and just after the fall of temperature when it may reach $\frac{1}{1000}$ to $\frac{1}{5000}$ or even very much higher. In 25% of the cases the reaction appears on the 6th or 7th day and never exceeds $\frac{1}{200}$ to $\frac{1}{500}$ It is stated a dilution of $\frac{1}{25}$ to $\frac{1}{50}$ may sometimes inhibit agglutination. Sera from other cases of illness and even from healthy persons will in a small proportion of cases (10% to 20%) give agglutination in dilutions of $\frac{1}{25}$ and rarely $\frac{1}{50}$.

It is generally accepted that complete agglutination in 8 hours in a dilution of $\frac{1}{50}$ is very significant of typhus infection. During convalescence this test will react in dilutions of $\frac{1}{25}$ to $\frac{1}{100}$ for 3 or 4 months. Sir Patrick Hehir writing in connection with a report on a hospital in Salonika states the Weil Felix is not present until the 6th day and he found 1 case out of 275 failed to react to this test.[9]

From experience of this test on S.A.natives it may be said

that it is of the utmost reliability and no case of clinically recognisable typhus has failed to react to it.

BLOOD COUNT. In most cases there is a leucocytosis which may serve to differentiate this disease from the enteric group where as a rule there is a leucopenia.

DIAZO REACTION. This is of very limited value as a diagnostic agent in typhus fever.

CEREBRO SPINAL FLUID. Devaux[10] states there is an early and constant leucocytic reaction. In the first week 10-12 microlymphocytes and 4-5 mononucleur to a field without any degenerate forms and one polynuclear to every 3 or 4 fields. During the second week 10-12 mononuclears of which some are in the process of disintegration a diminution of lymphocytes and increase in poly nuclears in proportion to thegravity of the prognosis and at the end of third week there is a rapid diminution of mononuclear with extreme predominance of disintegrating forms and persistence of microlymphocytes.

IN DIAGNOSIS OF TYPHUS FEVER IN THE S.A.NATIVE, in the absence of an epidemic, reliance should especially be placed on the history of sudden onset, great prostration, congested and coryzal appearance of face and injection of the conjunctiva, absence of knee jerks. The presence of these symptoms in a patient with a high temperature is deeply suspicious and the patient should be isolated pending a confirmatory Weil Felix test.

DIFFERENTIAL DIAGNOSIS.

Typhoid typhoid fever. If a case of typhus fever is seen for the first time about the end of the first week it can very easily be confused with a severe typhoid in the third week and here one must rely on the history, absence of knee jerks, and as a rule absence of tympanites for differentiation pending result of Weil Felix & Widal tests being obtained. In the earlier stages again reliance may be placed on the history of the sudden onset of typhus and the absence of knee jerks plus the congested appearance of the face and conjunctiva pending further observation and tests.

MALARIA. The examination of the blood film and the previous history of patient will usually make matters clear; it must be remembered, however, that the two diseases are sometimes present at the same time.

RELAPSING FEVER. The presence of spirochaetes in the blood film and the absence of rash and characteristic temperature serve to differentiate. Here also the two diseases may run concurrently.

INFLUENZA. Under South African conditions and with the presence of influenza of a severe type this has proved one of the most difficult diseases to differentiate from typhus fever. The points to specially look for are presence of rash, injection of conjunctiva, (in typhus this is more diffuse and affects the outer angle of eye more markedly,while in influenza the inner angle is more injected as a rule if coryzal symptoms

are present), early deafness, enlargement of spleen, absence of knee jerks, and continuance of fever after 3 days without any obvious physical signs being present in chest. When it is possible to have the advantage of a Weil Felix test as a rule the possibility of confusion with influenza has ceased.

PNEUMONIA. Mental symptoms are sometimes marked in pneumonia specially when of the apical type but the presence of the physical signs and absence of rash or splenic enlargement clear the matter up.

MEASLES & SCARLET FEVER. These as a rule present no difficulty as the rashes are quite distinctive and a measles rash can easily be seen even on a native's skin. South African natives are immune to scarlet fever so that as far as natives are concerned that disease causes no difficulty.

SMALLPOX. There is considerable resemblance between smallpox and typhus fever for the first 4 days but the appearance of the characteristic rash leaves no doubt.

CEREBRO SPINAL FEVER. There is sometimes much difficulty in differentiating in the early stages and it might here be noted that before typhus fever was definitely recognised in South Africa many cases were diagnosed as being cerebro spinal fever. Lumbar puncture is frequently necessary as a diagnostic measure when the cerebro spinal fluid in typhus may be found slightly turbid but little altered in its cell contents and no meningo coccal organisms will be present.

ENCEPHALITIS LETHARGICA. In this disease the onset is more gradual than in typhus fever. There is no splenic enlargement, and no rash and the temperature does not as a rule go much over 102°F. The pyrexia rarely lasts longer than 2-5 days. This disease is rare amongst the native population of South Africa.

TRENCH FEVER. This is not prevalent in civil life and hardly needs consideration. The short period of fever, tender shins, and absence of rash or enlargement of spleen may be noted.

TICK BITE INFECTIONS. There are several varieties of tick infections which are clinically in their onset and symptoms indistinguishable from typhus fever. In ixodiasis the South African tick fever which is prevalent in Uganda and German East Africa the organism may be found in the blood film but in Rocky Mountain fever the resemblance is so close that many observers consider the two diseases as almost identical and probably due to different varieties of the same organism.

PROGNOSIS. The case mortality of typhus fever varies in different epidemics, under different conditions, and in different races. Murchison states it is not more than 10% which estimate is confirmed by Moore.[11] Men die more than women and persons over twenty years of age succumb more readily than young persons. The following tables show this characteristic clearly and as they are from different countries present an interesting comparison.

A.London Fever Hospital a consideration of 18.138 cases.

- 5 years	6.69%	- 30 years	35.29%
10 "	3.59%	- 40 "	43.48%
15 "	2.28%	- 50 "	53.87%
20 "	4.46%	- 60 "	69.04%
		- 70 "	79.00%
		- 80 "	100%

B.Goodall's record of 5.747 cases in Warsaw end 1917.

Ages.	Cases.	Deaths.	Percentage.
- 10 years	908	7	0.7
- 20 "	2407	29	1.2
- 30 "	1035	43	4.1
- 40 "	717	71	10.0
- 50 "	513	86	16.7
- 60 "	112	59	52.6
- 70 "	50	19	38.0
- 80 "	5	3	60.0
	5747	317	5.5%

The more recent record shows an even lower death rate at the earlier ages than does the older. In Congress Poland in 1919 the case mortality was 7.8% and for Galicia it was 10.3%

For Europeans in South Africa the case mortality is about 10% but for the native races the writer is of the opinion that it does not exceed 5% or even less. Alcoholism is said to add to the seriousness of the prognosis but this need hardly be considered with regard to the native races in South Africa as the native has rarely access to much alcohol. It seems probable that with the long and continued presence of this disease amongst the natives they have acquired a certain amount of immunity to its ravages.

The early and marked appearance of nervous symptoms is a grave matter especially in patients over 40 years of age as is likewise a marked or haemorrhagic rash. Cases showing other signs of haemorrhage such as haematemesis, melaena, or haematuria are almost invariably fatal. Pregnancy is a serious handicap in this disease as abortion is almost inevitable and that throws an added strain on a patient who is as a rule already in serious difficulties. Should broncho-pneumonia or pleurisy develop the prognosis is not at all good and early incontinence is a symptom of grave import.

The writer has noted that cases showing hurried respirations without any signs of pulmonary lesions do very badly and are mostly fatal and in those cases that perspire profusely about the 10th or 11th day of the illness a fatal termination may be anticipated.

A patient suffering from a well developed attack of typhus fever has at the best a stiff fight for recovery and any complications however slight very seriously embarrass him.

ETIOLOGY & PATHOGENESIS.

Typhus fever having been associated from the earliest times with overcrowding and conditions favourable to this it came to be generally recognised about the beginning of the 19th century that infection was readily carried by clothes as

as well as by direct contact with persons suffering from the disease and it was observed that many laundresses who dealt with infected clothing became victims. Murchison considered the disease to be extremely contagious but did not believe the infection to be conveyed by air as he noted that the attendants on patients lodged in clean, well ventilated rooms did not readily get the disease. This aspect was emphasised by Harvey Littlejohn[12] who noted that of families living in a common stair only those contracted the fever who visited one another. The discovery in 1907 that the disease so frequently associated with typhus fever namely relapsing fever, was spread by lice directed the attention of observers to the possibility of this mode of the transmission of infection being common to both diseases and investigations were made in this direction. In the year 1909 this fact was definitely established by Nicolle and Conseil who were able to infect a monkey through lice previously fed on a typhus fever patient. Nicolle in Tunis and Goldberger and Anderson in Mexico subsequently confirmed these observations and Nicolle further showed that infection could be conveyed to guinea pigs from an infected patient's blood and also transferred from one guinea pig to another. He was able to propagate one strain 4½ years with a series of 150 passages through guinea pigs. The fact that the guinea pig is immune after one attack of fever has enabled the identity of various diseases such as Mexican typhus and Brill's disease to

be established with that of European typhus. It has been shown that the gut of a single infected louse, if emulsified and injected subcutaneously or intra peritoneally, is sufficient to infect and Da RocheLima estimates that the virus in the louse is ten thousand times more virulent than in the blood. Cases are on record where a single bite has proved sufficient to infect and Nicolle has further proved the excreta of the louse to be infective.While it is thus thoroughly established that the pediculus corporis is the carrier in most cases it has been shown experimentally that pediculus capitis can also carry infection although its importance as an infecting agent is probably not so great [13]. Many organisms have from time to time been discovered in connection with typhus fever but only three are of any importance and invite discussion.

Plotz in the year 1914 placed on record that he had isolated an organism (Bacillus typhi exanthematici) in culture by the use of a special method from the blood of a typhus patient. It is a diphtheriod bacillus usually gram-positive and it is said to agglutinate and give positive results by complement fixation technique when tested against the serum of a patient with typhus fever. Plotz and his co-workers cultivated this bacillus from several cases of Brill's disease and also from European typhus and from infected guinea pigs and monkeys. It has likewise been cultivated from cases of typhus in Serbia, and Olitsky, Denger and Husk have described

its isolation from lice and suggested its identity with Rickettsia prowazeki . It is however impossible to accept this organism as the causal agent in typhus fever since its injection has no pathogenic or immunizing effect and also the extreme rarity with which it has been isolated from lice. Many similar organisms have been isolated from infected blood in different epidemics and Wilson, Robertson & Denus suggest that these are a secondary invasion following the attack of fever. It has also been shown by Bacot, Horuichi and Wilson that other organisms such as B.proteus and sometimes B. typhosus and B.paratyphosusagglutinate with typhus patients serum.

Weil and Felix in 1916 recorded the discovery of an organism Bacillus Proteus X in the urine of patients with typhus fever and were able later to obtain similar cultures from blood and faeces. Two of the strains namely types X19 and X10 showed special agglutinating properties with typhus blood serum in fact type X19 practically invariably agglutinates with blood serum after the 7th day of the disease and it has therefore become valuable as a diagnostic medium. For similar reasons as those given in connection with Bacillus typhi exanthematici this organism cannot be considered as the essential cause of the disease and Weil and Felix look on it also as a secondary invader.

In the year 1916 Da Roche Lima described certain bipolar bodies which he had discovered in the bodies of infected lice and also in the blood of patients suffering from typhus fever. These bodies were demonstrated by Giemsa's stain and he described them as organisms having contours less clearly defined than bacteria and consisting of two substances, one staining faintly and the other, usually at the poles, taking a deep stain. The heavily stained polar portions are joined by a lightly stained outer substance and in the dark field they looked like paired granules while in water they disintegrate. They were 0.3 μ by 0.4 μ in size for single granules and 0.3 μ by 0.9 μ for the double granules or rods. Da Roche Lima found these bodies present only in a proportion of the lice examined and found they multiplied in the epithelial cells of the louse's stomach and he observed changes proceed in the cell by growth of the organisms which caused distention and finally rupture of the cells. Later in the year Möller confirmed Da Roche Lima's observations and about the same time Topper and Schüssler conducted some experiments by feeding lice on typhus patients finding many lice becoming infected after 4 days feeding and all after 9 days. The presence of these bodies which Da Roche Lima called Rickettsia prowazeki bodies (in memory of Ricketts and Prowazeki who fell victims to the disease) in the blood of persons suffering from typhus fever has not been definitely established by other workers but the

presence of these bodies in lice has been definitely proved to establish their infectivity.[14] The virus of the disease and these Rickettsian bodies are inseparable although it is noted that not all the lice feeding on a typhus patient acquire these bodies. Prof.Matthew Hay brought forward several reasons for considering the flea an infecting agent but it is now generally accepted that lice are the intermediate hosts.[15]

Several other forms of Rickettsian bodies have been found in lice notably Rickettsian fedrenti and Rickettsian quinrana, the former occurring in certain apparently normal lice and the latter in lice carrying the infection of trench fever. It is important to note in distinction that these Rickettsian bodies recur extra cellurly in the louse's stomach and adhere to the cuticular border of the stomach in a striking manner.[16] Whereas the R.prowazeki occur intra cellularly exclusively are strikingly pleomorphic, and very susceptible to drying and heat. In the blood the virus is present in washed and centrifuged corpuscles and in the plasma but not in the serum taken off the clot. Nicolle considers it specially associated with the white corpuscles but this is not yet established. The virus is not filter passing and can be rendered innocuous by exposure to 55°C for 30 minutes or even less or by the action of phenol 0.5% for one hour. Infected blood or lice excreta dried at 20°C over sulphuric acid no longer infect monkeys.[17] As it has not yet been proved that these Rickettsian bodies are transmitted to

succeeding generations of lice it is very difficult to understand how the virus of the disease lies dormant for the long periods that often intervene between outbreaks. The theory that there may be carriers is very difficult to accept in view of the fact that lice fed on convalescents do not become infected

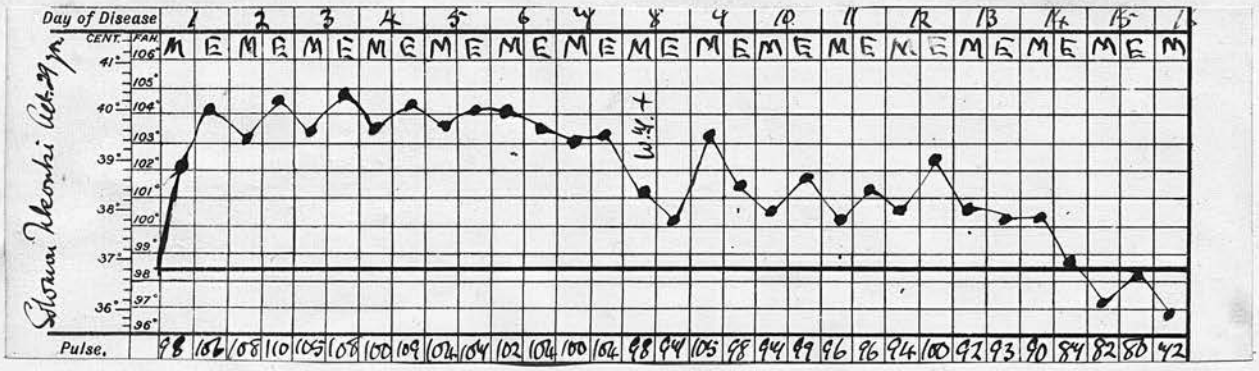
In South Africa the practically universal presence of body lice on natives makes it easy to understand how thoroughly typhus fever has become part of the life of these people. The insensitiveness of the native's skin to pain or irritation makes him make light or even not observe the activities of any insects that may seek nourishment on his body so one important incentive to cleanliness is lost. With the adoption of European clothes the native fails to adopt a reasonable standard of cleanliness - the same suit or dress does duty often for years without being washed or in many cases without the intervention of any underclothing which may be washed, thus providing a very agreeable stronghold for lice. In my opinion the raw uncivilizednative is less infested by lice than his so called civilized brother. The raw native uses a blanket loosely thrown over him as his sole covering and as there is free ventilation to the skin and there are few seams or corners on the blanket lice are not encouraged so freely especially as the native in this state lives very much in the sun. Living as practically all natives do in conditions of constant overcrowding (ten or more

natives may sleep in a small unventilated circular hut without windows, having only a small door,- approximately 10 feet in diameter and not more than five or six feet high inside) conditions are extremely favourable for the transference of lice from one individual to another.

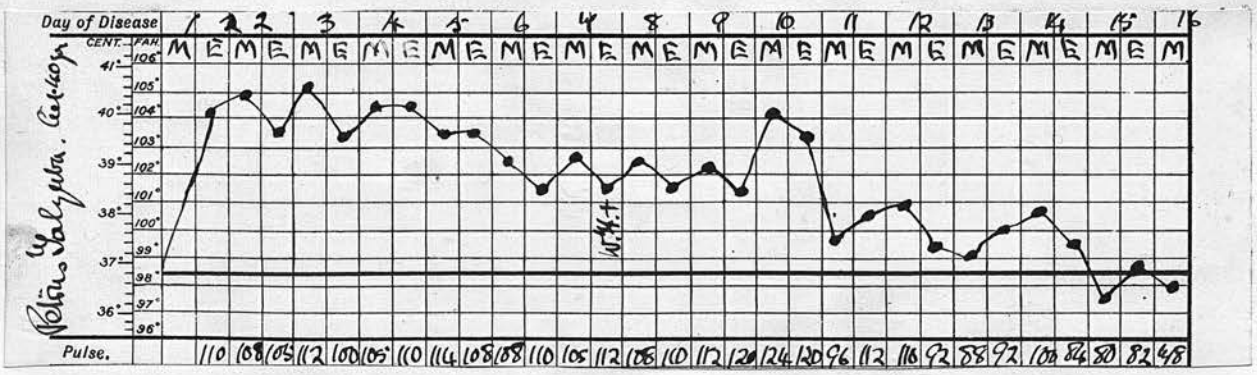
During the winter months in the writer's area the weather is extremely cold and then there is usually a decrease in the incidence of the disease contrary to the facts recorded in Europe and also in some parts of South Africa. A spell of warm weather and the advent of Spring is often co-incident with the appearance of more cases. The explanation of these facts is that the native who is an inveterate wanderer from farm to farm and district to district is kept at home by the cold weather but immediately conditions are favourable he gets to wandering again and so the disease is carried from place to place.

The question of where the virus lies between the outbreaks of the disease does not arise in S.Africa where typhus fever is always with us and in practically all cases the origin of infection may be traced. From time to time it is possible to trace cases to mild unrecognised cases occurring amongst children and suggests the possibility of this being a means by which the disease is kept alive during periods of its apparent quiesence.

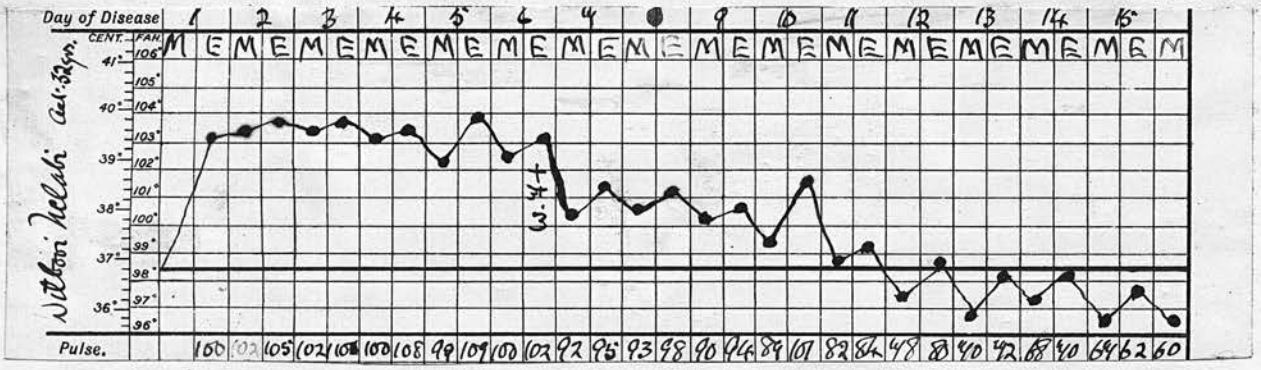
CLINICAL FEATURES AND NOTES OF CASES. A few temperature charts with brief notes of the cases concerned and the special points of importance in connection with them is herewith appended.



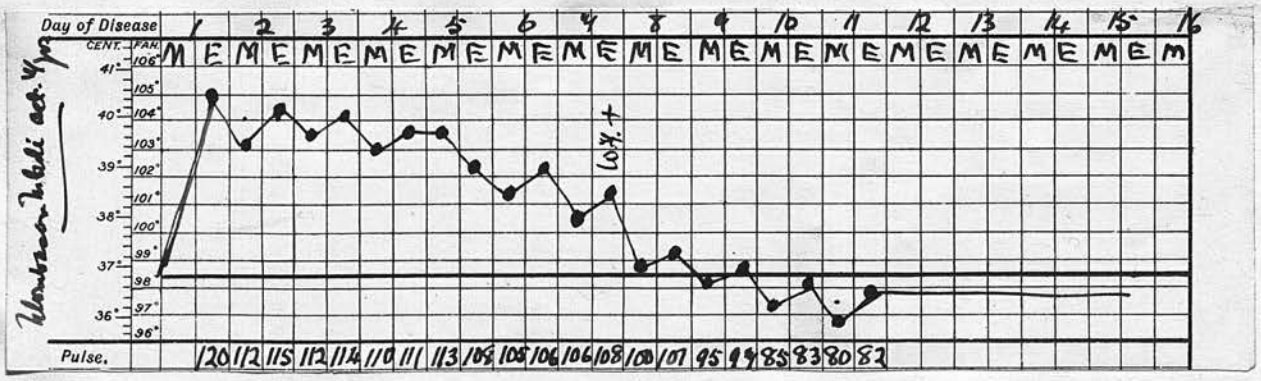
This is a typical chart of typhus fever showing sudden onset, slight remissions and pseudo crisis on the 8th day with termination on the 14th day by rapid lysis.

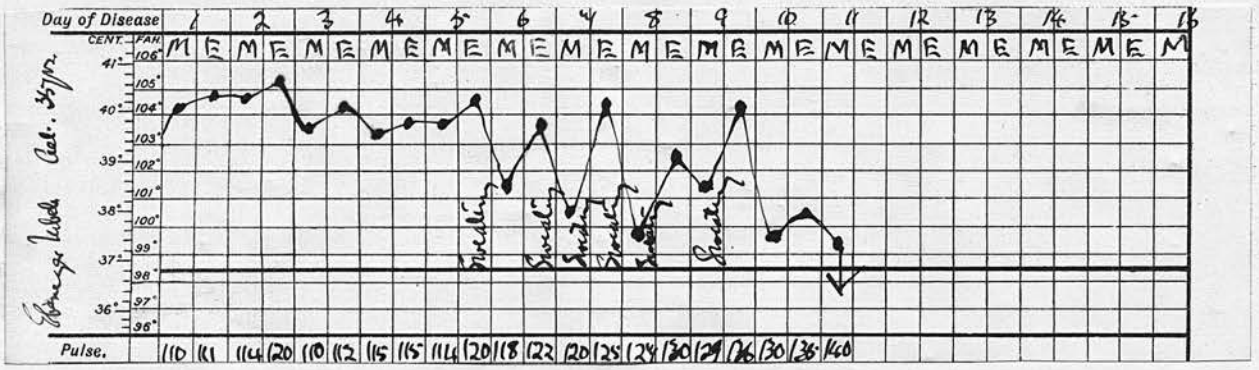


This is also somewhat typical of the disease but shows remissions of temperature in the evening instead of the morning.

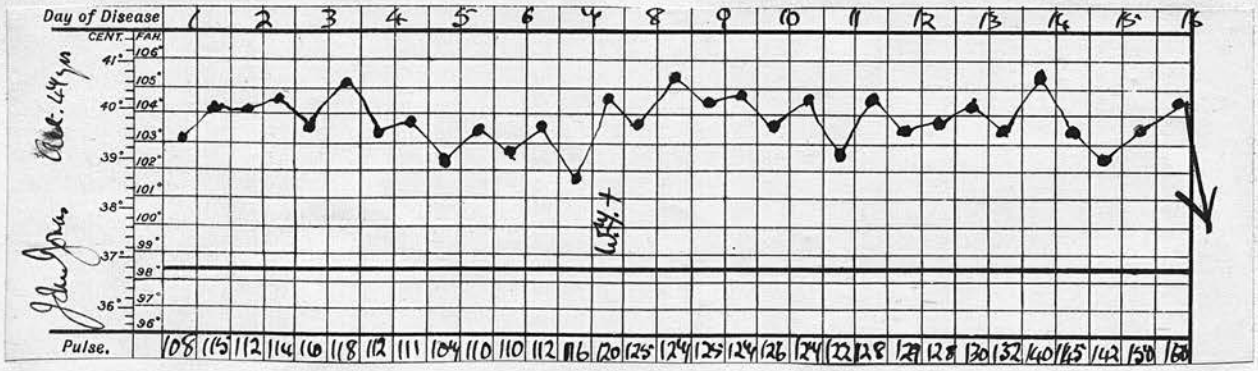


This chart is typical of a mild case temperature reading normal on the 12th day and the chart below shows the progress of an average case of typhus fever in a child 7 years of age.





The above is the chart of one of those cases showing marked and profuse sweating beginning about the 5th day of illness. There was no special cardiac or bronchial involvement and no really marked mental symptoms. The writer's experience is that all cases showing this feature do badly the sweating being accompanied by marked prostration and cardiac collapse. All efforts at treatment by salines, atropine, cardiac stimulants etc.usually prove of no avail when this symptom appears before or on the 6th or 7th day of the disease.



The above chart shows the appearance of broncho-pneumonia

as a complication about the 9th day. This complication usually follows those cases in which bronchitis has been a prominent symptom from the beginning. It may here again be pointed out that bronchitis is not a very common accompaniment of the disease unless the weather be cold and adverse, and the large number of cases that occur without any signs of bronchitis makes one hesitate to accept the statement that bronchitis is an essential concomitant of typhus fever as it is in measles. Cases in which broncho-pneumonia is well developed are usually fatal in from the 15th to the 21st day, rarely do they carry on much longer than the 17th day.

TREATMENT. Typhus fever is a disease in which careful nursing is of the utmost importance if a satisfactory result is to be obtained. The patient should be strictly confined to bed in a large and well ventilated room and should there remain until convalescence is well established. The mattress of the bed should be soft and elastic and the utmost care must be given to prevent the occurrence of bed sores especially in those cases where coma present. Native cases in South Africa do well without the convenience of beds as they have hardly ever been accustomed to such luxuries, and rarely develop bed sores in spite of a minimum of nursing and attention.

DIET. From the outset patients should have nourishing and easily digested food in as large a quantity as their digestive

organs can deal with without discomfort. The diet should have a minimum food value of 2500 calories and it should contain about 70 grms of protein if possible. A diet consisting mostly of fluids will be found most convenient and milk and its modifications should form the largest part. Milk in any form, tea, coffee, cocoa, soup, eggs, gruel and jellies may be given and if necessary the milk may be peptonised or malted. Buttermilk or sour milk is of value and the usual milk puddings such as rice, sago, semolina etc are often very acceptable. Toasted bread and rusks are excellent when patient feels well enough to eat them as they help to clean up the tongue and teeth and help the general comfort. Sugar in form of toffee or added to the various milk foods is of great value and there is no doubt that apart from its use in sparing the body proteins it is a valuable cardiac stimulant. Water should be given freely at all times either plain or in the form of barley water, lemonade, soda water etc. Lemon juice and oranges are very comforting to the patient and provide a valuable addition to the vitamines in the diet. The mouth and teeth should be carefully attended to an d cleaned after each feeding and a mildly antiseptic mouth wash should be used freely.

The native confines his diet mainly to "amaas" (that is milk that has been allowed to turn sour in a calabash or ordinary jar) and from time to time some cooked mealies (maize) rarely obtaining any meat, meat soup or any other variety of

diet. It is remarkable how well these people do on this simple and restricted dieting and they do not seem to lose more weight during the illness than the pampered European. It is unfortunate that the native has a great dislike for water when ill and it is very difficult to get them to consume even a reasonable quantity.

HYDROTHERAPY. This form of treatment is of the utmost value in typhus fever and should be employed in all cases when the temperature exceeds 103°F or when mental symptoms predominate. It may be employed either by cold sponging, cold pack or by the bath. The latter method is most valuable in cases showing marked nervous symptoms and should always be employed in those cases when cardiac condition permits. Cases showing great prostration should not have the bath treatment but the milder forms of hydrotherapy may usually be carefully employed with benefit.

MEDICINAL. No specific drug treatment is available for this disease and antipyretics are distinctly contra indicated as prostration is as a rule a feature of the condition. Where sleeplessness is a troublesome symptom a hypnotic is necessary and here paraldehyde is best but if necessary a hypodermic injection of morphia may be usefully employed as it is unwise to allow this symptom to predominate for any length of time. For cardiac failure hypodermic injections of strychinine hydrochlor ($\frac{1}{20}$ - $\frac{1}{30}$) combined with Digitalin ($\frac{1}{100}$ - $\frac{1}{50}$) every four hours is useful and regular doses of whisky or brandy are of value in

tiding over a crisis. Oxygen may also be administered and when passed through alcohol and given by a suitable inhaler it acquires an especial value in heart failure and prostration.
INJECTIONS OF NORMAL SALINE SOLUTION, per rectum, intra venously or subcutaneously has been found of great value in this disease and the regular administration of this may often with benefit be commenced as early as the 8th day. It is advisable to continue the saline treatment in a decreasing degree for some days after the temperature has fallen to tide over any danger of collapse.
SERUM. Various methods of serum treatment have been tried. The serum of convalescents has been injected into patients intra-venously and subcutaneously, citrated blood from convalescents has been used and antitoxic serum from horses and asses (Nicolle and Blazot) has also had its trial. Ortini injected patients own serum into spinal canal and Von Liebwski has tried the reverse process.

No real success has been achieved so far from any of the serum methods and treatment on these lines is at present abandoned 18
The constipation which is present in most cases should be treated by mild laxatives such as extract Cascara sagrada or by enemata as if any of the stronger purgatives are used there is a tendency to the production of diarrhoea.
PROPHYLAXIS. This is extremely important in dealing with typhus fever and the early diagnosis and isolation of first cases is of the greatest value in preventing a further spread of the disease.

Whenever the nature of the infection is suspected or ascertained immediate steps must be taken to destroy all lice and nits on patient himself, his clothes and belongings. He should be isolated, his clothes removed and disinfected, his hair should be cropped short and measures adopted to kill all lice and nits on his body while all attendants should wear louse protected clothing. All contacts should be thoroughly disinfested and disinfected and if possible segregated and carefully inspected daily for signs of the disease for at least 16 days. A suitable propaganda by lectures and literature should be carried out in the neighbourhood making clear the nature of the disease and emphasising the danger of louse infection and a careful watch should be kept for any other cases of illness that may occur. The patient should be isolated for a week after the temperature is normal and a careful disinfestion should be conducted before he is discharged.

Various methods of prophylactic inoculation have been tried sometimes with serum of typhus patients sterilized with carbolic acid (Lebailly and Poirson) or by typhus infected blood sterilized by heating to 60°C for ½ an hour (Otto & Rothacker 1919) but with no very satisfactory results. Sir Patrick Hehir, however, reports that serum inoculation has proved so satisfactory in Greece that the Government propose to make it compulsory.[19]

Quinine has been used empirically as a prophylactic measure in this disease. The writer has experimented with this but has

formed no favourable opinion of this method of prophylaxis.

From the foregoing paragraphs it will be gathered that as a means of prophylaxis it is necessary chiefly to rely on the measures against lice and a few notes on the habits of these insects and the means of combating their activities will be necessary.

THE LOUSE, mainly concerned in the spread of typhus fever is the body louse (pediculus corporis) but as it is possible the head louse (p.capitis) may also play a part, it is essential to exterminate all lice. The body louse adheres to the clothing and is most prevalent on those parts of the clothing that press most closely on the skin e.g.fork, armpits, belt etc. In natives lice have been observed adhering to a necklace when no other clothes were worn. Lice die of starvation when separated from their host and the length of time they can live without food depends on the temperature. The lower the temperature the longer they can live without food and they have been known to live under favourable conditions as long as ten days without nourishment. A louse finds a new host by chance contact so overcrowding is the surest and easiest way of spreading lice amongst the population. The migration of lice is hastened, their activity being increased, by warmth and persons with fever present the best conditions possible for increasing the liability of any lice on them to migrate. It has been proved that the rate of migration is doubled by a rise

of body temperature to 100°F. It is therefore obvious that while it is easy enough to acquire lice by contact at any time a person in the neighbourhood of a lice infested person with typhus fever is doubly liable to become infested, therefore energetic measure must immediately be adopted for the destruction of all lice.

DISINFESTION. To disinfest the person the hair should be cut short and the scalp soaked with paraffin to which a small proportion of sassafras oil has been added. This is allowed to remain on for ½ an hour and then wash off with soap and warm water. The remainder of the body should be washed with hot water containing a liberal proportion of lysol. The clothing should be treated by heat or steam or by soaking in a 2% solution of lysol in water which is kept at a temperature of over 40°C for 30 minutes, that is just rather hot for the hand.

Hot air or steam may be used instead of a solution and of these dry heat is less damaging to the clothing. The exposure to hot air for one minute at a temperature of 65°-70°C or for ten minutes at 58° to 61°C is sufficient but in practice a somewhat longer period is allowed for safety.

In South Africa Dr.Sheldon has introduced a portable disinfestor which has proved very useful. It consists of a small canvas tent 4 ft.7 in.high 4 ft.4 in.long 3ft.3 in.wide with a centigrade thermometer introduced on a guide post at the top. The air inside is heated by a large blow lamp which plays through a wide sheet iron tube on to a baffel plate inside and this dis-

tributes the heat throughout the interior. As the whole outfit only weighs 116 lbs.it has proved very useful for taking to various out-of-way and mountainous parts.[21]

In dealing with a typical outbreak in a native kraal in South Africa the following measures are taken. The patient and family are isolated, disinfested(persons and clothing) and the hut is thoroughly cleansed and disinfected. All contacts are thoroughly disinfested and disinfected and their movements are restricted to the farm infected. The neighbouring kraals and farms are warned against coming to the infected area and thorough disinfection and disinfestion is carried out there likewise. Whenever possible guards are appointed to supervise the patient and his family and to see that all instructions as to isolation are properly carried out. Lice destroying oil (Naphthaline in nut oil 1-8) is supplied freely to all comers and its use generally encouraged throughout the district.

SUMMARY AND CONCLUSIONS.

1. Typhus fever is not a new disease to the South African native but is of ancient origin.

2. The Rickettsia prowazeki is definitely associated with the virus of typhus fever.

3. Bronchitis is not constantly present in typhus fever and it is doubtful if it is an integral part of the disease as in measles.

4. Suddenness of onset is an almost constant feature of the disease in South Africa.

5. A rash is found in a larger percentage of native cases in South Africa than is usually believed if carefully looked for.

6. A positive Weil Felix test is obtainable in practically all cases of typhus fever after the 6th day of the disease and it is the only laboratory test of value for diagnosis.

7. The case mortality from typhus fever in the native races of South Africa is very low and much lower than that of Europeans there and in Europe.

8. The native has a certain amount of immunity to the virulence of the disease as is shown in many cases by the shortened duration of an attack.

9. Complications of the disease are rare amongst natives in South Africa.

10. Profuse sweating occurring before the 6th day of the illness warrants a grave prognosis.

11. Mild spells in winter and the advent of spring increase the incidence and spread of typhus fever.

12. The only reliable means of prophylaxis and protection are disinfestion, disinfection and protection against lice.

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